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The Refrigeration Service Engineer

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Vol. 3
No. 1

JANUARY • 1935

Mechanically Refrigerated Trucks—
Refrigeration Controls—Servicing
Welsbach Refrigerators—Water Valves

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The REFRIGERATION SERVICE ENGINEER

Devoted to the Servicing of
REFRIGERATION UNITS *and* OIL BURNERS

VOL. 3 JANUARY, 1935 NO. 1

Table of Contents

Mechanically Refrigerated Trucks Offer Increased Opportunity for Service Men 3

Refrigeration Controls (Continued from December), *by L. B. Miller* 5

Shooting Trouble with the Aid of the Observation Chart, *by H. Herkimer* 10

News of the Manufacturers 13

Servicing the Welsbach Refrigerator 14

Automatic Water Regulating Valve, *by C. F. Toussaint* 23

Another Year 26

New York Chapter R.S.E.S. Recommends Standard Service Charges 27

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The Refrigeration Service Engineer

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

OFFICIAL ORGAN REFRIGERATION SERVICE ENGINEERS' SOCIETY

VOL. 3, NO. 1 CHICAGO, JANUARY, 1935 $2.00 per Annum

Mechanically Refrigerated Trucks *Offer Constantly Increasing Opportunity* for Service Men

WITH the rapid increase in the number of refrigerated truck users who are turning from other forms of refrigeration to the various mechanical systems, there is opened up a big and constantly increasing opportunity for service which should prove of real interest to a great many service men.

One system, in particular, namely the Kold-Hold system, is forging ahead at a very rapid pace, and the prediction that this will soon be the predominant method of truck refrigeration apparently is not unfounded. Several hundreds of installations have been made during the past two years since the Kold-Hold System was taken over by R. E. Olds of automotive fame, all of

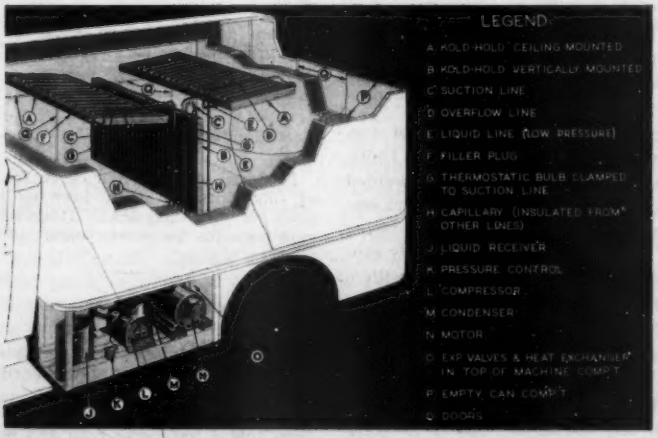


FIG. 1. APPLICATION OF KOLD HOLD SYSTEM TO TRUCK.

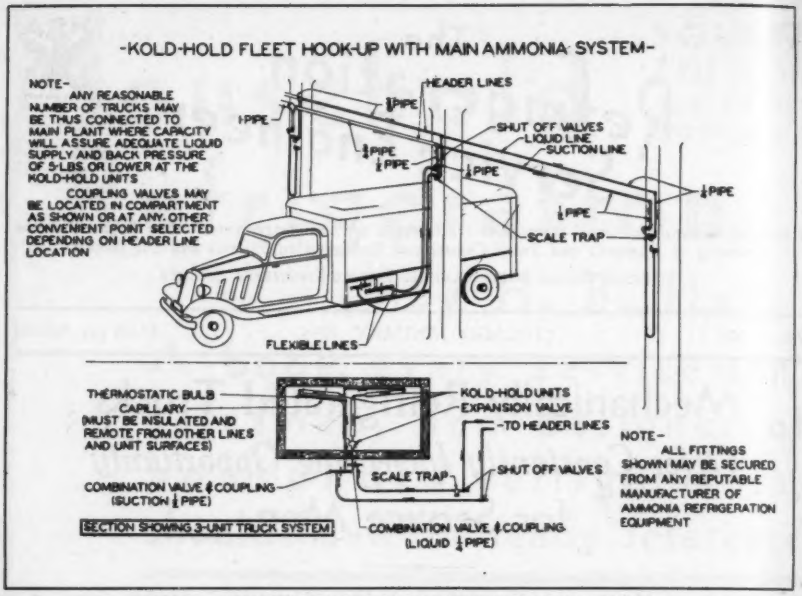

-KOLD-HOLD FLEET HOOK-UP WITH MAIN AMMONIA SYSTEM-
NOTE- ANY REASONABLE NUMBER OF TRUCKS MAY BE THUS CONNECTED TO MAIN PLANT WHERE CAPACITY WILL ASSURE ADEQUATE LIQUID SUPPLY AND BACK PRESSURE OF 5 LBS. OR LOWER AT THE KOLD-HOLD UNITS
COUPLING VALVES MAY BE LOCATED IN COMPARTMENT AS SHOWN OR AT ANY OTHER CONVENIENT POINT SELECTED DEPENDING ON HEADER LINE LOCATION
HEADER LINES
SHUT OFF VALVES
LIQUID LINE
SUCTION LINE
SCALE TRAP
FLEXIBLE LINES
THERMOSTATIC BULB
CAPILLARY
(MUST BE INSULATED AND REMOTE FROM OTHER LINES AND UNIT SURFACES)
KOLD-HOLD UNITS
EXPANSION VALVE
TO HEADER LINES
SCALE TRAP
SHUT OFF VALVES
COMBINATION VALVE & COUPLING (SUCTION PIPE)
COMBINATION VALVE & COUPLING (LIQUID PIPE)
SECTION SHOWING 3-UNIT TRUCK SYSTEM
NOTE- ALL FITTINGS SHOWN MAY BE SECURED FROM ANY REPUTABLE MANUFACTURER OF AMMONIA REFRIGERATION EQUIPMENT

FIG. 2. CHARGING SYSTEM FOR REFRIGERATED TRUCK.

which are said to have proven exceedingly satisfactory. Numbered among its users are many of the largest users of refrigerated trucks, most of whom, according to the manufacturers, are gradually converting their entire fleets to this system or have already done so.

Those of our readers who are interested in the truck phase of refrigeration, we believe, will find the following highlights of the Kold-Hold system worth reading.

Mechanically the system consists of one, two, three or more Kold-Hold Cooling Units, either suspended from the ceiling or mounted vertically in the truck body, which are employed as the low side of the refrigerating system. Each unit consists of a sturdy container made of rust-resistant steel with a finned, seamless-steel type, flat-grid type evaporator submerged in a patented true cryohydrate which freezes at a predetermined temperature.

The units are charged or frozen usually at night while the truck is idle, either by means of a compressor on the truck, hook-up with a compressor in the garage, or, as is the case in many instances, hook-up with the central plant ammonia system.

J. Delano Brown,
Pennsylvania.

I am greatly pleased with the Service Engineer and look forward to receiving each issue.

Bert Kendrick,
Utah.

Enclosed you will find check for renewal of subscription. Please keep up the good work on your magazine. It certainly is a gold mine for the service man.

Vincent Krueger
Missouri

I have just subscribed to your publication and have just received the September and October issues.

I think that it is one of the best publications that I have ever read and would like to obtain all of the back copies possible.

Refrigeration Controls

(CONTINUED FROM THE DECEMBER ISSUE)

In this Article, the Author Continues the Description of Various Air Conditioning Controls. It Indicates the Scope and Flexibility of Controls Available

By L. B. MILLER *

IN the December issue we continued this article after describing and illustrating the Floating Control. Continuing we discuss other "hook-ups" which may be employed.

Modulating or Proportioning Control

Six or seven years ago, our company developed the so-called proportioning control for use in industrial process installations. Success of this system was so marked that the idea of its application to ventilating and air conditioning work was apparent. A great deal of development work was necessary in order to reduce the cost of the equipment and about three seasons ago it was offered for use in this service. The definite advantages of the control has been proven in hundreds of satisfactory operating installations and its flexibility which will be later described, seems to indicate that it is a definite contribution to the air conditioning industry.

The principle of operation is to regulate in increments of motion through increments of controller changes. Putting this in another way, any increment of change at the controller results in a proportionate change of the controlled means. To the industry, this method of control is offered under the trade name of the Modutrol System which includes its application to all types of heating, ventilating, cooling, and complete air conditioning systems.

Figure 8 is a schematic diagram showing the principal parts of a simple Modutrol System consisting of one controller and one Modulating or Modutrol motor. The power unit consists of two small induction type units that are geared to the same shaft and electrically connected to run in opposite directions. In this respect the power unit is similar to the so-called floating type. It is different, however, in that it is provided with a balancing potentiometer, consisting in a sliding contact, geared to the final drive of the motor, which wipes the resistance to form the potentiometer.

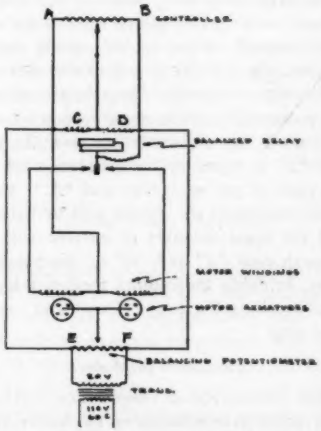


FIG. 3. MODULATING OR PROPORTIONING CONTROL.

Insofar as the controller is concerned, it may be standard in all features of any conventional controller with the exception that the switching means of either single pole single throw or single pole double throw type is replaced with a potentiometer, which consists of a coil of resistance wire over which is swept a sliding contact positioned by the temperature pressure sensitive element. The balancing relay consists of two identical coils of wire in which an armature operates to move a contact reed between two fixed contacts. These contacts in turn control the operation of the two motors and when the circuit is in balance the reed is in midposi-

* Refrigeration Division, Minneapolis-Honeywell Regulator Co.

tion between the two fixed contacts and the motor is stationary.

As the sketch is drawn, the controller is in midposition and the motor is in midposition also. With an increase in temperature the sliding contact will be moved to some position toward point "A." It will be seen that this action divides up the resistance AB into unequal parts. Under these conditions more current will flow through the coil "D" of the balancing relay than coil "C" and the contact reed will be pulled toward the right hand contact of the motor switch, causing the motor to operate in a clockwise direction. This action will cause the sliding contact on the balancing potentiometer to move toward "E" until the resistance between the slide and "E" is equal to the resistance between the slide of the controller and "A." Under these conditions the circuit will be balanced and the equal amounts of current will flow through coils "C" and "D" of the balancing relay, bringing the contact reed to midposition, breaking the motor circuit and causing it to stop.

Rotation of Motor

Any further rise in temperature will cause a proportionate rotation of the motor in the same direction, the motor stopping when the resistance in the controller and the balancing potentiometer circuits are balanced. Should a drop in temperature take place the slide in the controller will be moved in the opposite direction, and the motor itself rotated in the opposite direction, stopping when the resistance in the two circuits are again balanced.

From this explanation it is obvious that the motor does not float, but rather takes definite positions in its arc of rotation which are directly proportional to the magnitude of temperature changes at the controller. It is further evident that if the differential of the controller is assumed to be 2°—that is, it will take 2° to the sweep the slide from point "A" to point "B"—and there are thirty turns of wire, for example, in the resistance unit, there will result thirty positions of the motor throughout its 180° of rotation and each position will be equivalent to 1/15° of temperature change. It is further obvious that by changing the controller differential and for the number of turns in the resistor unit, unlimited possibilities in the way of accuracy and sensitivity may be obtained at the control means.

An example of the remarkable flexibility of the system may be indicated by pointing out that there need not be a single controller to operate the motor. The controlling means may be made up of two, three or more controllers, which may be connected electrically in such a manner as to regulate the controlled means as a resultant of the three or more functions represented by the controllers. This resultant action may be an average of the three factors or may be a resultant of the three functions which may appear in the control circuit in any weight which their function demands.

Two important examples of this, namely, a Compensating Control and a Compensated Effective Temperature Control are described in the following. These two control systems have been widely used during the past season on air conditioning installations with highly satisfactory results which indicates they bid fair to play a very important part in the future control of air conditioning equipment.

For the purpose of brevity the application of these two systems as applied to the cooling cycle only will be described. It should be understood, however, that with the necessary modification, application to the heating cycle is readily effected.

Compensated Control

Past experience with air conditioning systems, speaking now of the cooling cycle, has proven the existence of a shock to the human being in going from a warmer temperature to the cool temperature, together with a decided feeling of discomfort in going from the cooler temperatures back to the warmer temperatures. This occurs when there is a wide difference in temperature between the outside and inside. This condition indicated to the American Society of Heating and Ventilating Engineers that it would be advisable to maintain a lower difference in temperature and to regulate this difference with a rise in outside dry bulb temperatures. This difference between outside and inside temperatures has not been recommended as

a constant, but in itself also increases with the rise in outside or street temperature.

It is safe to say, we feel, that it is not the opinion of the Society that this is the final rule to follow, but rather the rule to use until further experience has indicated something better. In the following table is listed the indoor conditions to be maintained with various outdoor dry bulb temperatures and is predicated on subject exposure of less than three hours.

Outdoor Temp. Deg.F.°	Indoor AC with Constant Dew Point @ 57° F.		
Dry Bulb	Dry Bulb	Wet Bulb	Effective Temp.
95	80	65.0	73
90	78	64.5	72
85	76.5	64.0	71
80	75.0	63.5	70
75	73.5	63.0	69
70	72.0	62.5	68

Modulating Compensated Control. In this type of control it is assumed that the results must be a modulating action such as would be found in the manipulation of dampers or valves. It is desired to bias or adjust the inside dry bulb temperature with the outside dry bulb temperature in accordance with the values laid down in this table.

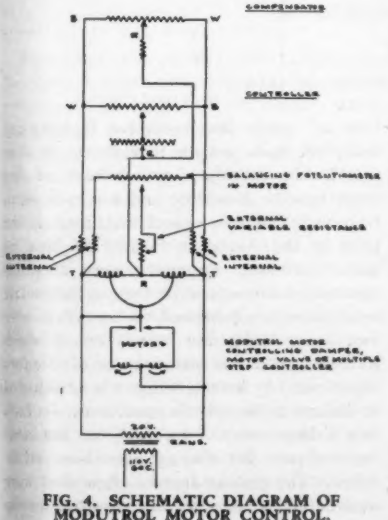


FIG. 4. SCHEMATIC DIAGRAM OF MODUTROL MOTOR CONTROL.

Figure 4 shows a schematic wiring diagram in which the Modutrol Motor is being regulated by an outside compensator and an inside controller. In the diagram the top resistance, marked compensator, represents that found in a temperature control which is subjected to outside dry bulb temperature. Next down the two resistances, a wide one and a second resistance, which is provided with a center tapping, represent the two resistance units that are incorporated in the controller and operated in unison from the single thermostatic element. This controller is subjected to the effect of inside temperatures. The rest of the diagram represents a standard Modutrol motor with one exception, that it is provided with an external variable resistance which will be described later.

Compensator Adjusting

Referring to the table, if the compensator is subjected to an outside dry bulb of 75° it determines this temperature and automatically adjusts the operating range of the inside controller to 73.5°. The differential at which this inside controller will operate about this point, whether it be one, two, three or what not degrees, is adjusted by means of the external variable resistance which is in the form of a manually operated rheostat and so designated in the schematic diagram. Since this resistance is adjustable, the operating characteristics of the control system may be adjusted after installation to any peculiarities that may be existent in the system. If necessary through wide fluctuations in load conditions, it may also be employed as a means for compensating these unusual circumstances.

With an outside dry bulb of 85° the inside controller will be set or adjusted to operate at 76.5°. With an outside dry bulb of 95° the inside controller will be adjusted to operate at 80°, etc.

Control of On and Off Loads. The control action for modulated dampers and valves of all types has been described in the foregoing. In the cooling cycle there are very definite requirements for this compensated control to in turn regulate refrigeration com-

pressors, electrical valves, and occasionally two-position dampers or valves. In such control the Modutrol Motor is replaced by balancing relay, the light contacts of which in turn control heavier duty relays, giving on and off action.

Figure 5 is a schematic wiring diagram

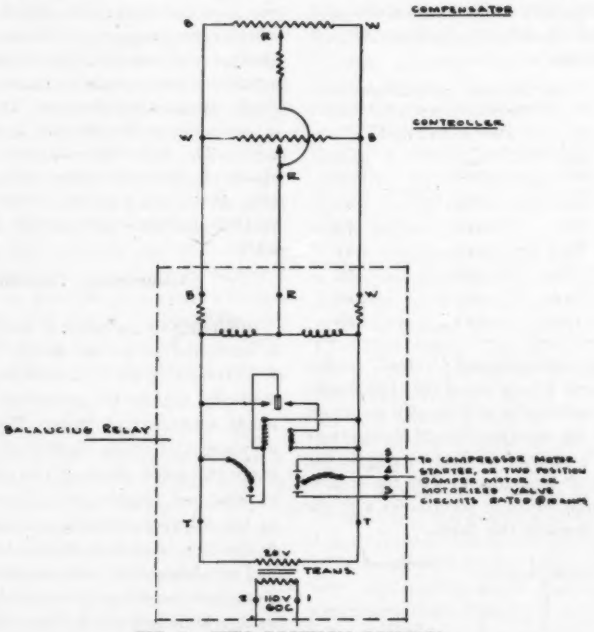

COMPENSATOR
CONTROLLER
BALANCING RELAY
TO COMPRESSOR MOTOR STARTER, OR TWO POSITION DAMPER MOTOR, OR MOTORIZED VALVE CIRCUITS RATED @
TRANS.

FIG. 5. TWO POSITION CONTROL.

showing such arrangement. As in the control of Modulating Systems, the compensator or outside temperature control appears in its usual form and the inside controller has in this case only one resistor, which is electrically all that is necessary. The resultant action of these two controls is similar to that of the Modulating Control in that the inside dry bulb is adjusted in accordance with the requirements demanded by the outside compensator and the control points on the inside are established in accordance with the requirements outlined in the table.

The function of the resistance shown in the red wire at the compensator is to definitely establish a control differential, regardless of whether the movable slide in the two controllers may be at their opposite extremes or not.

Compensated Effective Temperature Control

In comfort cooling, human comfort is the final result to be obtained. This result is not alone a function of dry bulb temperature but really involves three factors, dry bulb, wet bulb and air movement. It may likewise be considered a resultant of dry bulb, relative humidity and air movement. Extremely extensive experiments made in the past by the American Society of Heating and Ventilating Engineers were diagrammatically represented in the psychrometric in which was established the so-called comfort zone, within the boundaries of which were indicated various degrees of comfort experienced by human beings when subjected to different atmospheric conditions. In fact, two distinct zones of comfort, one for heating and one for cooling have been established. The various degrees of comfort were designated by an arbitrary resultant or in-

dex which was termed effective temperature. This is not a temperature that may be measured by a thermometer, but rather is an indication of relative comfort experienced by human beings.

we should take into consideration the biasing or adjustment of inside dry bulbs with outside dry bulbs, therefore, our ideal control should be a system in which the inside effective temperature is measured in accordance

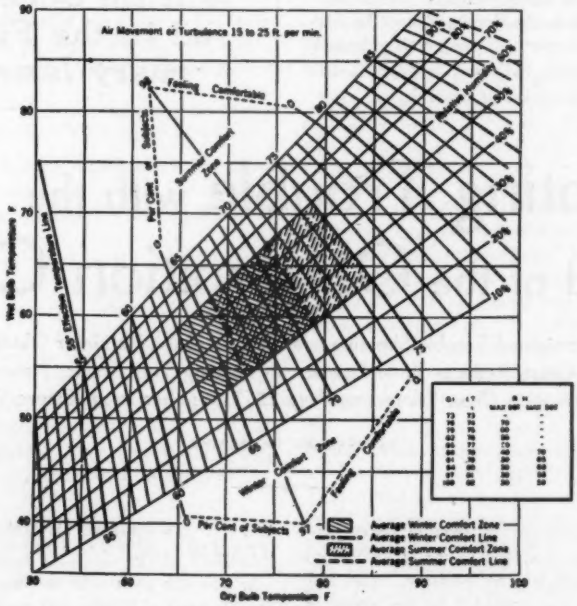

Air Movement or Turbulence 15 to 25 ft. per min.
Feeling Comfortable
Summer Comfort Zone
Per Cent of Subjects
Wet Bulb Temperature F
Dry Bulb Temperature F
Winter Comfort Zone
Feeling Comfortable
Per Cent of Subjects
Average Winter Comfort Zone
Average Winter Comfort Line
Average Summer Comfort Zone
Average Summer Comfort Line

FIG. 6. COMFORT CHART.

Figure 6 illustrates the comfort chart with its comfort zones and is predicated on air velocities of 15 to 25 feet per minute, which in reality is considered still air.

In view of the foregoing it is therefore obvious that cooling for comfort should be controlled in terms of effective temperature rather than in terms of dry bulb temperature only. While it is maintained by some that it is dry bulb temperature that determines the shock, it also seems to be the consensus of opinion that relative humidity is a major factor in the determination of comfort after the subject has been exposed long enough to acclimate himself to the conditions. Air movement also plays an important part to the effect that as the air movement increases, the effective temperature may be increased for the human being to experience the same degree of comfort. Since with outside dry bulb temperature.

Referring again to comfort zone on the psychrometric chart, we observe an interesting phenomena in connection with dry bulb and relative humidity. In the summer comfort zone, note for example the line of 71° effective temperature. The high limit of relative humidity is 70% and the low limit is 30%, while the respective dry bulbs are 74° and 79° F. Any combination of dry bulbs and effective temperatures falling along this line represent conditions of equal comfort to the human being. In the past two cooling seasons experience has indicated that 70% relative humidity is rather high and it now seems to be the consensus of opinion that the top limit of relative humidity should be maintained at 60%.

Summing up the foregoing it would therefore appear that with any value of relative

humidity along any line of effective temperature, shall we say from 70° to 75° within the so-called summer comfort zone, this value of relative humidity may be used to measure a complementary value of dry bulb temperature and a control point established from this result. In other words, if the relative humidity is high, the dry bulb must be lowered, and conversely, if the relative humidity is low, the dry bulb may be permitted to rise to a higher point of control.

This Article on

refrigerator controls illustrating and describing various "hook-ups" on air conditioning controls

Will Be Concluded in the February Issue

Shooting Trouble with the aid of the Observation Chart

Systematized Trouble Shooting with the Aid of the Herkimer Observation Chart, Reduces Time Losses. In Reading This Article, Have the Observation Chart Printed on Page 25, December Issue, Before You.

By HERBERT HERKIMER

THE development of trouble charts appearing in previous issues is associated with the growth of the industry. The first trouble chart was compiled by the writer in 1925, and from time to time new trouble charts have been developed which simply rearrange the tabulation of causes and effects. Troubles of yesterday are the troubles of today and tomorrow. In other words, a "Trouble Chart" is systematized universal knowledge. Methods of analyzing troubles, however, improve from day to day as we become more experienced. The refrigerating industry is a growing one and the art and science of servicing develops accordingly. As the number of refrigerators increase, the demands upon the service engineer increase and he must increase his personal efficiency and production accordingly to keep pace with demands in the rush season.

How Is it Possible for a Service Engineer to Increase His Production?

1. He can subscribe to the REFRIGERATION SERVICE ENGINEER.

2. He can improve his technical skill in the use of tools.

3. He can gain a little time by shooting trouble more skillfully and rapidly.

4. He may organize his day's work and movements more efficiently.

The first trouble chart appeared in the June, 1933, issue, and was revised in December, 1933. We printed the latest chart revised December, 1934, on page 25 of the December issue, and the reader will note the title has been changed from "Trouble Chart" to "Observation Chart," which the writer thinks more appropriate.

What Is First Class Operating Condition?

A refrigerating unit when installed under contract is considered in first class operating condition when the buyer and the seller agree that specified temperatures are obtained and all duties are performed as agreed.

A domestic unit is considered to be in first class operating condition when both the serv-

ice man and the user are satisfied with the operating characteristics of the electric refrigerator.

As a general rule if a domestic unit makes ice cubes in a satisfactory period of time one may be sure that the unit is in practically good operating condition and if there are any troubles they are usually minor troubles or control troubles and not major troubles.

What Is Trouble; What Is a Complaint?

In the following discussion the word "Trouble" is defined as a cause or any circumstance that interferes with first class operating condition.

The writer desires to call the attention of the reader that the word "Trouble" is, therefore, a technical term. The word "Trouble" means nothing to the user or the owner. Trouble can only be recognized by the service engineer.

However, the Effects of Troubles in a refrigerating system is to cause said owner to make a Complaint. A Complaint, therefore, is not a technical term but a common, everyday word.

General Refrigeration Troubles; Circulating Trouble; Control Troubles; Major Troubles; Minor Troubles

A. *General Refrigeration troubles* may be divided into two divisions:

(1) Circulating troubles inherent in the circulating system itself.

(2) Control troubles usually associated with the prime mover; also with the thermostatic or pressure control.

B. *Circulating troubles* may be divided into two classifications:

(1) Major circulating troubles.

(2) Minor circulating troubles.

In the revised chart (December issue) is given details describing the causes of major and minor troubles based on Classification "B." However, for purposes of explanation circulating troubles may also be divided according to two other methods of classification:

(1) Troubles due to improper amount of liquid entering the evaporator.

(2) Troubles due to improper amount of vapor being removed from the evaporator.

Anything that interferes with the proper amount of liquid, if any, entering the evaporator or the proper amount of vapor being removed from the evaporator is a cause of circulating troubles.

What Is a Service Call?

The observation and analysis of cause of trouble is defined as service engineering or "the service call." Fixing the trouble is defined as Installation.

Systematized Servicing

Certain sequences of observation from 1 to 10 on "Observation Chart" recommended may not be desirable in every case, nevertheless, it serves as a good basis for systematizing a service call. It is found that the system herein described has been instrumental in increasing the number of calls which a man has been able to make in a day.

What Is the Major Cause of Circulating Troubles in a Refrigerating System?

After making observations from 1 to 10, service engineering is finished and installation begins in routine from 11 to 19.

In the following topic the author defines three major causes of circulating trouble, tabulated on Observation Chart as follows:

11. *Inefficient Compresser* caused by:

(A) Bad compressor discharge or suction valves.

(B) Bad piston rings—2 cylinder split gasket.

(C) Not pumping enough gas or too slow speed.

12. *Orifice too small* caused by:

(A) Stuck shut needle or restriction.

(B) Closed receiver valve.

(C) Plugged liquid line or strainer (dirt, ice).

(D) Restricted suction.

(E) Rate of flow too small.

13. *Undercharge* caused by:

(A) Leaky seal.

(B) Leaky joint.

(C) Careless in charging.

It is to be noted at this point in the discussion that if the compressor proves under

test to be inefficient, it should be overhauled immediately and reinstalled before the installation man attempts to remove an expansion valve, float or restriction or to even consider charging the system. Suppose, for instance, not only is the compressor inefficient but the liquid or suction line is stopped up and at the same time the system requires an additional charge. How is it possible for these troubles to be analyzed until the compressor is overhauled? The compressor is just as important a tool or instrument for testing as the gauge or ratchet wrench. If the compressor is overhauled and reinstalled then a test is made checking up whether or not the orifice is properly adjusted or whether it is too large or too small. In other words, the system should not be charged until the compressor has been overhauled and the orifice adjusted properly.

14. *Air in system* caused by:

(A) Leaky low side or seal.

(B) Neglect in purging.

15. *Orifice too large* caused by:

(A) Needle too far off seat.

(B) Rate of flow excessive.

16. *Overcharge* caused by:

(A) Careless in charging.

17. *Unit runs too long time* caused by:

(A) Switch set too low cut-out.

(B) Thermostat bulb too warm.

18. *Unit does not run long enough* caused by:

(A) Switch set too high cut-out.

(B) Thermostat bulb too cool.

19. Efficient compressor-pump sufficient gas.

Correct liquid supply—orifice properly adjusted.

Correct gas charge and percentage oil—no air.

Effects:—(Restatement)

Before a written report can be made upon a refrigerating unit whether or not it is in first class operating condition, it will be necessary for the service engineer to make what is called an "observation run" or test. Refrigeration service engineers are interested in effects or observation listed under column 1 to 10. The installation man is interested in Causes 11 to 18.

Causes:—(Restatement)

The effects or observations investigated are due to certain "Causes" or "Troubles." It is the cause of the trouble that the service man must discover. These causes are listed from 12 to 18 in the Herkimer Observation Chart. Decisions regarding a cause must be based upon a study of the observations.

* * *

COPELAND, MAYFLOWER AND ZEROZONE MOVE TO ONE PLANT

A CONSOLIDATION of manufacturing facilities of three concerns manufacturing refrigerators, commercial condensing units and air conditioning equipment is announced by Dallas E. Winslow, President of Dallas E. Winslow, Inc., parent corporation of Copeland Refrigeration Corporation, Mount Clemens, Michigan, Trupar Manufacturing Company, Dayton, Ohio, and Zerozone Refrigeration Corporation, Chicago, Ill.

The combined operations of these three units will be housed in the manufacturing plant located at Holden and Lincoln Avenues, Detroit, formerly used by Lincoln Motor Car Co. This plant has a floor area of upwards of 200,000 square feet, with service from three main line railroads.

Copeland Refrigeration Corporation was formerly located in Detroit, then transferred to Mount Clemens, and now returns to its original locale in order to take advantage of improved manufacturing facilities.

The three corporations affected by the move will need the services of approximately 500 employees, to take care of a turnover of several million dollars annual business. Products manufactured are Copeland, Mayflower and Zerozone domestic refrigerators, commercial refrigeration for stores, hotels, factories and institutions, and air conditioning equipment for homes, business establishments, hotels and public buildings.

Occupancy of the new quarters is to begin December 1st and a large force of mechanics are now engaged in the transfer of machinery and equipment from the former locations of the three corporations affected.

MATHESON ISSUES REFRIGERANT MAILING PIECE

WHETHER the Matheson Co. is going "right" or "left" or is just talking "turkey" is doubtful from their new price list. On the left inside page they veer to the "right"; but on the right inside page they veer to the "left"; and on the other pages they seem to be talking "turkey." Who says there is no "art" in the refrigeration business? The Matheson people are artful, by any standard.

The mailing piece combined a season's greeting to the service men with price information on the various refrigerants they stock.

HERKIMER INSTITUTE OFFERS AIR CONDITIONING COURSE

THE Herkimer Institute has recently announced an addition to their course on refrigeration. The new course is on air conditioning, treating its elementary and advanced principles and practical application.

The plan of training for the air conditioning course consists of two sections, so arranged as to begin with preliminary material to provide a thorough groundwork for the more advanced considerations.

The course is arranged for spare-time study, and is complete in the various applications treated. Descriptive literature on this course may be obtained by addressing the Herkimer Institute, 1819 Broadway, New York City.

BROWN INSTRUMENT COMPANY CONSOLIDATES WITH MINNEAPOLIS-HONEYWELL

THE recent consolidation, whereby the Brown Instrument Company of Philadelphia became a subsidiary of Minneapolis-Honeywell Regulator Company of Minneapolis, unites two of the largest and oldest firms in the temperature control field.

Both companies are pioneers, the Brown Instrument Company having been established in 1860, while the Minneapolis-Honeywell Regulator Company was organized in 1885. Today, Minneapolis-Honeywell maintains branch and distributing offices in fifty-eight cities and subsidiary companies in Canada and Europe. The Brown Instrument Company maintains twenty-two branches throughout the United States.

The consolidation, which marks another step in the growth of the Minneapolis-Honeywell Regulator Company, comes on the eve of its 50th anniversary and completely rounds out and complements its line of heating, ventilating, cooling, humidifying and air conditioning control equipment for domestic and large building applications as well as its line of automatic industrial process controls.

"In view of the fact that the acquisition of the Brown Instrument Company rounds out and complements the Minneapolis-Honeywell line, both companies will be operated independently of each other," said C. B. Sweatt, Vice President in Charge of Sales of the Minneapolis-Honeywell Regulator Company. "The Brown Instrument Company will be operated as a separate company and it is expected that all of its branches and personnel will be maintained.

VIRGINIA SMELTING CO. APPOINTS NEW AGENTS IN CALIFORNIA

THE Virginia Smelting Co. takes pleasure in announcing that it has appointed the Refrigeration & Power Specialties Co. of 380 Brannan Street, San Francisco, and Mr. Van D. Clothier, of 1015 East 16th Street, Los Angeles, as their agents for distribution of their Extra Dry Esotoo and also V-Meth-L in the States of California and Nevada.

We understand that Messrs. Braun, Knecht, Heiman of San Francisco, and the Braun Corporation of Los Angeles, who have been exclusive agents in California and Nevada for the Virginia Smelting Company for the past twelve years, will on February 1st become exclusive sales agents for Sulphur Dioxide manufactured by Great Western Electro Chemical Co., and that therefore after February 1st they will not be in position to sell Extra Dry Esotoo, the nationally known and trade marked brand of refrigeration grade sulphur dioxide, which is made by a patented process, exclusive with the Virginia Smelting Company.

Servicing the Standard Welsbach Domestic Refrigerator

(CONTINUED FROM THE DECEMBER ISSUE)

In this Article is Described the Expansion Valve and the Sylphon Seal. Also a Complete List of Possible Difficulties and Their Remedies

CONTINUING our description of the Welsbach Ethyl Chloride refrigerator we consider the expansion valve and sylphon seal and the difficulties the service man is likely to encounter with this equipment. Also service suggestions in overcoming difficulties.

Welsbach Expansion Valve

In Figure 8 the nipple (1) to which the liquid delivery line is affixed, has fastened to it a screen (2) of mesh so fine that even small particles of dirt cannot pass this point and thus interfere with the proper functioning of the expansion valve. This assembly is screwed into the valve tee or body (3), the junction being made tight by the use of a lead gasket. A hard steel ball (4) is held against a seat or opening (5) in the valve body by the pressure of a spring (6) against ball retainer (7). These parts are held in place by the cap (8) which is also made tight to the valve body by a copper disc (9).

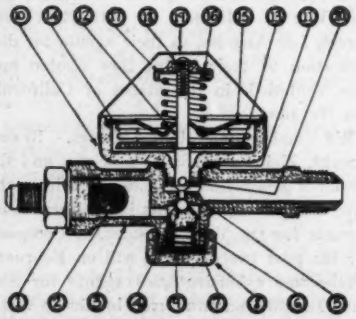


FIG. 8. WELSBACH EXPANSION VALVE.

To the valve body (3) is screwed a cup shaped body (10), another lead gasket (11) insuring a leak-proof joint. Fitting loosely through the opening in the center of valve cup (10) is spindle (12), which extends into the valve seat opening (5) of valve body (3), almost touching ball (4). To a shoulder of stem (12) is soldered a disc (13), which on its outer edge is soldered to a short sylphon or flexible metal bellows (14). The other end of the bellows (14) is soldered to the valve cup (10). On the rim of the cup (10) is a disc or a spider (15), so shaped that its depressed center acts as a seat for the spring (16), which at its upper end is capped by a spring washer (17), and which is pressed against a knurled adjusting nut (18) on the upper end of spindle (12). A cover (19) caps the entire assembly and shields same from the rapid accumulation of atmospheric moisture. The natural tendency for the spring (16) to force the stem (12) upward is resisted by the stop-pin (20) crosswise in spindle (12), striking the valve cup body (10).

Upon installation, before the expansion valve cover (19) is put in place, the pocket formed by bellows (14) and plate (13) must be filled with pure Nujol, so that any atmospheric moisture which might condense within this pocket will not freeze and cause the valve stem or spindle (12) to stick.

In addition to its connection with the liquid delivery line at the fitting (1), the opposite end of the valve body (3) is connected to the freezing unit expansion coil inlet near the top of the freezing unit.

If it is desired to change the vacuum, it is done by adjusting the pressure on the spring by means of the knurled adjusting nut (18). If a higher vacuum is desired, the nut is tightened down; if a lower vacuum, then it is loosened up.

In making expansion valve adjustments, only a part of a turn should be taken on the adjusting nut at a time, and ample time should be allowed for the system to regain

its equilibrium. It is usually possible to make a lower vacuum adjustment quicker than a higher one. A half turn of the nut will usually produce an inch change in vacuum.

The proper setting of the expansion valve for domestic cabinets is between 19 and 21 inches. The lower the vacuum the more economical will be the operation and the unit will run less frequently. The vacuum should not be set so low, however, that the return line will frost back beyond where it leaves the cabinet. This should be observed toward the end of the operating period.

Sometimes in spite of the care to keep foreign matter out of the system some gets between the ball and seat, with the result that too much refrigerant passes and the vacuum falls. Frequently the particle that is holding the valve open can be dislodged by flushing the expansion valve. This is done when the machine is running by pressing the stem down. This pushes the ball well off the seat and the rush of refrigerant removes the obstruction.

In case flushing the expansion valve does not remove the particle that is keeping the ball from seating, the nut (8) should be removed; the spring (6), ball retainer (7), and ball (4) taken out and cleaned. Any particles that may be on the seat should also be wiped off. Of course the machine cannot be in operation when this is being done, nor can this be done until pressures are balanced to prevent the escape of liquid refrigerant. Replace the parts when cleaned and start machine. If dirt between the ball and seat was responsible for the low vacuum, its removal will allow the expansion valve to function properly and no adjustment need be made if this was not changed before cleaning.

Regardless of the vacuum gauge reading the vacuum is too low if the ⅜" vapor return or suction line is frosted more than 8" from the point where it emerges from the bottom of the freezing unit. Similarly the vacuum is too high if this line is not frosted

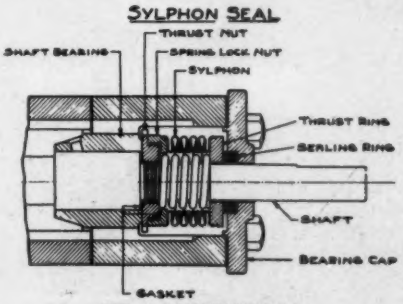


FIG. 9. SYLPHON SEAL.

at least 3" or 4" from the point where it emerges from the bottom of the freezing unit.

Whenever glycerine is found in an expansion valve cup (installations prior to the Fall of 1928), wipe it out and replace with Vexol.

Sylphon Seal

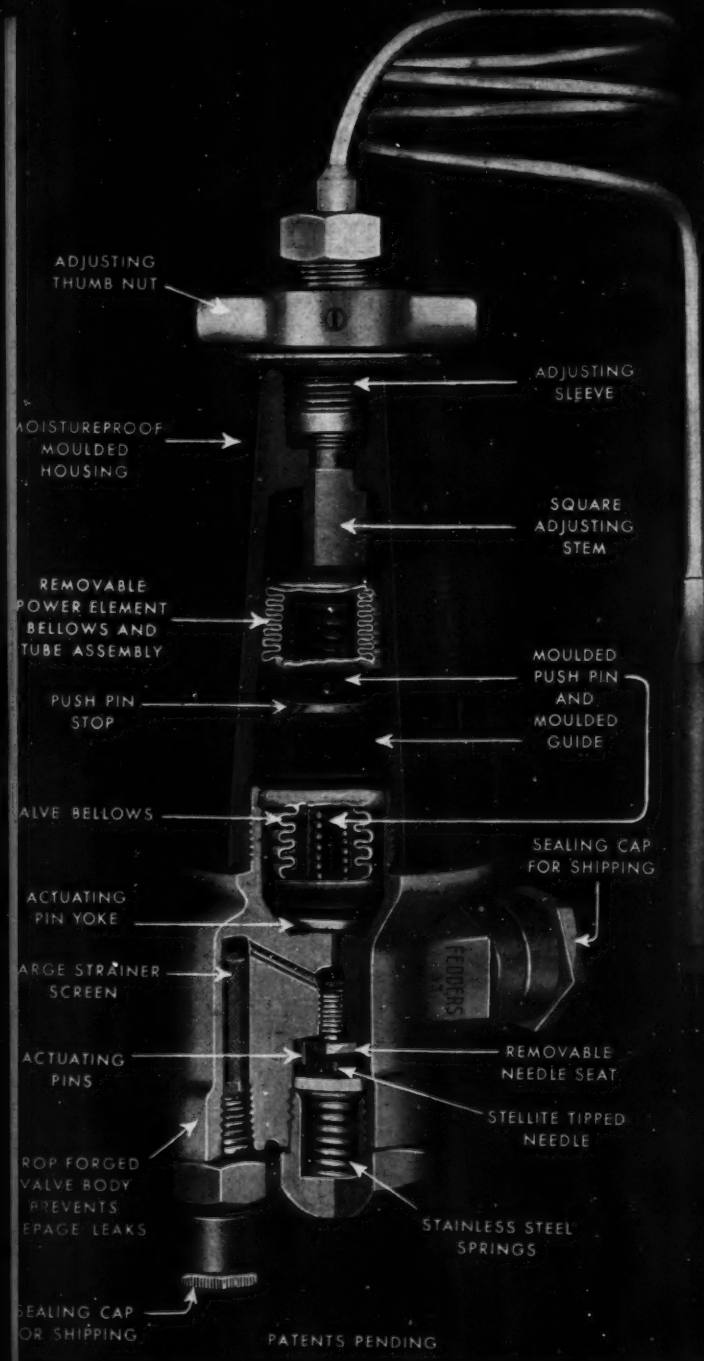
As previously described, if pressures build up in excess of 50 lbs. per square inch, the seal will (illustrated in Figure 9) "blow," releasing the pressure by allowing lubricant as well as a portion of the charge of refrigerant with its admixture of air to escape. Ordinarily the seal will then reseat itself and will function normally when the conditions which made it "blow" are remedied. If the seal is damaged, however, as evidenced by leakage at this point, it is best to replace with new parts the sealing ring cap and the sylphon assembly which screws on to the drive shaft.

DIFFICULTIES AND THEIR REMEDIES

Moisture or Dirt in System

The presence of moisture or dirt in the system is revealed by erratic operation, particularly of expansion valve, as indicated by unsteady or abnormal vacuum gauge readings.

Moisture in the system is apt to freeze as it passes through the expansion valve. The resulting ice restricts the flow of Alcozol. With Alcozol no longer flowing into the freezing unit, the freezing unit will warm up until the ice melts. This alternate freezing and thawing will continue intermittently as long as moisture is present. It is indicated by a fluctuating vacuum. Before the mois-



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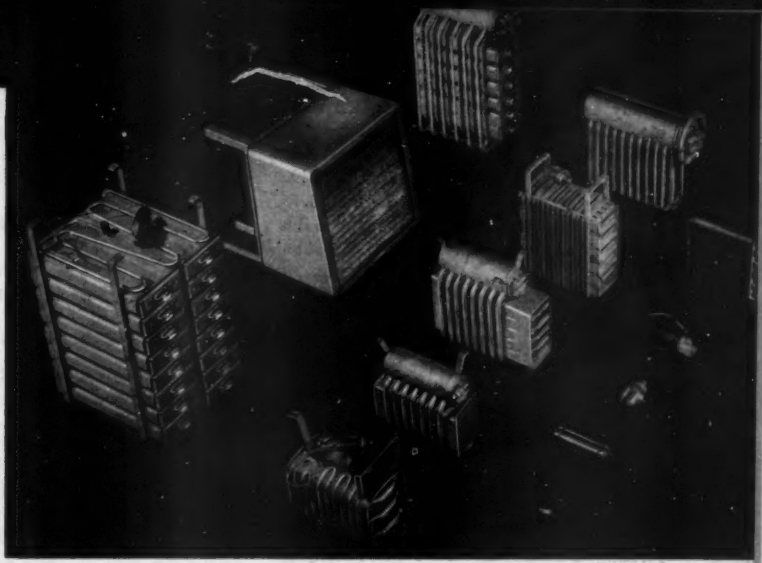

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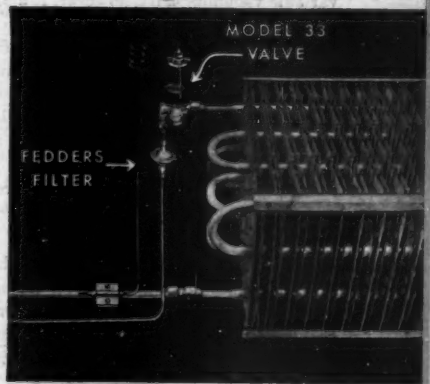

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ture freezes, the vacuum gauge will remain steady at its proper setting. As the moisture freezes, the gauge will show increasing vacuum, reading up to about 28″. It will remain at this point only until the ice has thawed when it will drop back to normal.

To determine whether it is a stoppage due to dirt or excessive moisture in the system, it is only necessary to warm the expansion valve either with a rag dipped in hot water or by holding the hand against it. With the equipment in operation, if the vacuum reading drops from 28″ or higher to approximately normal value when the expansion valve is heated in this manner, then moisture is responsible for the trouble. In a system with excessive moisture the vacuum at starting will usually be normal but rises suddenly to 28″ or more after a few minutes operation. This rise of vacuum is caused by ice forming in the expansion valve and stopping the flow of refrigerant.

The presence of dirt or foreign matter in the system is likewise indicated at times by variable vacuum. Dirt, however, is more apt to accumulate on the screen in the expansion valve—gradually restricting the flow of refrigerant and finally cutting it off entirely. The presence of dirt in sufficient quantities to interfere with operation is first indicated by an increasing vacuum. When the screen is finally stopped entirely, the vacuum gauge reads about 28″ and the tank will defrost.

Remedy for Moisture in System

If moisture has been circulating through the system, the only satisfactory remedy is to clean and dry the entire system thoroughly. This can best be done by washing the whole system out with alcohol and then removing the alcohol with refrigerant.

Remedy for Dirt in System

The remedy for dirt in the system is to remove both the expansion valve screen and the screen filter in the liquid delivery line and wash same clean with alcohol. When cleaning the screen and filter, it is well to flush out the ¼″ liquid line from the receiver. If dirt is circulating in the system, it will usually accumulate in the liquid receiver before being forced into the liquid delivery line and clogging either the cartridge strainer or expansion valve screen.

In blowing out this ¼″ line, care should be taken that lubricant and refrigerant are not spilled on the cabinet. They will mar the nitro-lacquer finish. If, in spite of your precautions, lubricant and refrigerant are blown against the cabinet, be sure to wipe clean and dry immediately.

In aggravated cases of dirt, the entire system should be washed with alcohol.

Overcharge of Refrigerant or Air in System

There are only two conditions which can affect the temperature-pressure relationship of refrigerant in the Welsbach System. The pressure will be abnormally high if there is air in the system and also if the system is overcharged with refrigerant. Properly charged and free from air, however, the pressure will never vary from the scale printed.

With a temperature of 70 degrees in the liquid receiver, the pressure will always be 6.2 pounds; just as at a temperature of 80 degrees the pressure will always be exactly 10.4 pounds; at 90 degrees always 15.4 pounds; at 100 degrees always 21 pounds.

If your pressure at any given temperature exceeds the pressure shown for that temperature in the table, it absolutely and conclusively proves that there is air in the system or that the system is overcharged.

In a system containing air, the pressure will be higher than normal for the receiver temperature when the machine is idle as well as when it is in operation. If the high pressure is due to an excessive charge of refrigerant, filling the condenser tubes with liquid, the temperature-pressure relation will be normal when the machine is idle. On starting the machine, however, the pressure will start to rise abnormally at once without a material increase in temperature.

In making a comparison between temperature and pressure, remember that it will take at least ten and probably fifteen minutes for the thermometer to show a true reading. The thermometer should be placed in the well which is sunk into the receiver. The machine should be operating when this test is made—even if it is necessary to short-circuit the thermostat in order to maintain operation.

Whatever difference existed between the actual pressure found and the ideal pressure indicated in these tables will continue to exist without change if no air is admitted to the system. If, for instance, when you leave an installation, the receiver temperature was 90 degrees and the pressure, instead of being 15.4 pounds, was actually 17 pounds, there will always be a difference of 1.6 pounds between the actual reading on that system and the pressure indicated in these tables. If at any time this difference is more than 1.6 pounds regardless of the temperature at which the pressure is taken—it is a positive indication that air has been introduced into the system since the earlier reading was made. Use this test always. It enables you to leave a machine absolutely free from air and gives the greatest possible assurance of continuous satisfactory operation.

Remedy for Overcharge of Refrigerant

If the system has too much refrigerant, the remedy is apparent: Remove the whole amount and recharge correctly.

Remedy for Air in System

Having determined that air is being introduced into the system, it becomes important not only that you find a point at which air is leaking in, but that you also determine positively that there are no other leaks.

It is impossible to find a leak unless the system is under pressure greater than that of the surrounding air.

To build up pressure, the following steps should be followed in order given:

1. Operate the machine with the vacuum gauge port and valve open.

2. Be sure that the pressure gauge is in place on the liquid receiver. (Do not install the pressure gauge in the lubricant separator chamber plug port.)

3. Operate the machine until the pressure gauge reading approximates 50 pounds.

4. Shut down machine.

5. Close valve to pressure gauge port.

6. Transfer pressure gauge to the open vacuum gauge port.

7. Flush expansion valve by pushing down on adjusting stem—holding it down until the pressure gauge in the vacuum gauge port indicates an equalization of pressure on both sides of the system by attaining a maximum reading—about 80 pounds.

It is immaterial whether or not the machine is charged with refrigerant when following the above procedure.

Zero Test

1. Discharge all refrigerant from system.

2. Close condenser shut-off valve tightly, being sure that circulating valve at liquid receiver remains open and that all gauges have been removed.

3. Remove plug from lubricant separator chamber of compressor (or use gauge port when compressor is equipped with two-way condenser shut-off valve).

4. Insert a union (¼″ pipe x ¼″ S.A.E. or ⅜″ pipe x ¼″ S.A.E.) when two-way condenser shut-off valve requires this fitting.

5. To this union attach a short length of ¼″ copper tubing.

6. Connect this to a small piece of glass tubing by means of a rubber tube.

When refrigerant is discharged there still remains some Alcozol mixed up in the lubricant in the compressor, as well as some of the gaseous refrigerant in the coils. It is necessary therefore to—

7. Start the motor and allow compressor to run for 20 or 30 minutes to exhaust most of the remaining refrigerant from the system.

8. After the machine has run 20 or 30 minutes, as called for under note 7, and not before, place end of glass tube 2″ below the surface of alcohol in a glass container. (Under no circumstances use anything but alcohol for this test.) The alcohol will absorb the small amount of gas that might still exist in the system, hence no bubbles will appear if the system is tight.

Caution: Alcohol will become saturated if the glass tube is placed in bottle before the initial 20 or 30 minute run.

If bubbles appear with regularity, a leak is indicated; if they appear at lengthening intervals, they are probably due to gas in system. A service man should use his watch in this test. A system may not be considered

perfectly tight until an interval of 25 minutes has lapsed without a bubble.

9. At the conclusion of the Zero Test, and prior to recharging the System, be sure to replace the plug in the two-way condenser shut-off valve or the lubricant separator chamber before shutting down machine. (This will prevent air entering system.)

This method will determine whether the system is tight excepting for the joints on the high side of the compressor.

A leak in the expansion coil underneath the surface of brine in the brine tank will not be revealed by bubbles in the Zero Test. If the leak is large, the compressor will pump liquid. If a small leak in the expansion coil is suspected, proceed as for "Locating Leaks" by building up pressure on both sides of system—removing the filler cap from the brine tank and sealing the opening with a film of soapy water. A leak in expansion coil will be revealed by a "soap bubble" at filler mouth. A small leak may be suspected if the odor of alcohol is detected when flushing out compressor for the Zero Test, or if the lubricant appears unusually thin, or moisture recurs often.

Elimination Test

In case the Zero Test reveals a leak that cannot be found by the soap bubble Leak Test use the following elimination test.

1. With the condenser shut-off valve closed as for the Zero Test and glass tube still connected and immersed in alcohol.

2. Break ⅜" suction joint at compressor.

3. Cap suction fitting tightly.

4. Run Zero Test for 20 minutes as before. If no bubbles appear, the compressor can be considered tight and the leak must be located elsewhere.

5. Reconnect ⅜" suction line to compressor.

6. Break ⅜" line at suction union on brine tank.

7. After capping, run Zero Test for 20 minutes as before. If no leak is revealed, the compressor and first length of suction tubing are then known to be tight.

Subsequently: Test successively all joints until the appearance of bubbles indicates a leak in the last portion of the system tested —joints being found at:

⅜" connection of expansion valve to brine tank.

¼" connection of liquid line to expansion valve.

Both ends of cartridge strainer.

Two-way circulating valve at liquid receiver.

Liquid receiver connection to condenser.

Condenser connection to shut-off valve or ell fitting.

After locating a leak, it may be eliminated by replacement or otherwise, and the test should then be continued until all parts of the system are found to be tight.

Important: When capping or plugging tubing for the elimination test, it is recommended that a cap be made from tubing by flaring one end of a short piece of tube and placing a flare nut thereon. The other end of the tube should be flattened out with a hammer and *soldered.* If tube is not soldered, air will leak in. Do not use dead end caps that are supplied with parts for the protection of threads, as these will not pull up tight.

Cleaning System

If an accumulation of dirt clogs the expansion valve screen or screen filter, or the lubricant seems to contain finely divided dirt, the system should be washed out with alcohol. The alcohol wash is also the only certain way of eliminating moisture from the system.

Caution: Use only special, completely denatured alcohol. (Do not use alcohol denatured with pyridine, Ethyl Acetate, etc.)

1. Discharge all refrigerant from the system. Throw this away.

2. Shut down machine.

3. Remove the ball, ball retainer and ball spring from the expansion valve.

4. Replace the bottom cap.

5. Remove nipple and strainer from expansion valve at connection with liquid delivery line.

6. Replace with a strainerless nipple.

7. Disconnect the ¼" liquid line at the screen filter.

8. Slip a piece of rubber tubing over it.

9. Place the other end of the rubber tubing in a bottle containing two quarts of alcohol, so that the alcohol will be sucked up

to the expansion valve when the pump is put in operation.

10. Remove the screen filter.

11. Fasten a piece of tubing on the ¼" liquid line connection of the receiver—placing the open end in the alcohol bottle (see 9). When new type receiver valve is used, it will be necessary to insert a ¼" bushing and ¼" S.A.E. fitting into the opening of the valve when the strainer is removed.

12. Operate the compressor. Both receiver valve and condenser shut-off valve should be open.

13. The alcohol will be drawn through the system to the compressor, pass through it, and into the condenser, flowing from it to the receiver, from which it will be discharged back into the bottle after dissolving the dirty lubricant and carrying away the dirt and any moisture that may be in the system. To build up the pressure necessary to discharge the alcohol back into the bottle, pull the suction tubing out from under the surface of the alcohol intermittently—thus admitting air—and allow the alcohol to circulate until the color of the fluid being discharged is approximately the same as that being drawn in from the bottle. Sometimes the alcohol will build up a high pressure in the compressor, causing it to pound and in some cases blowing the seal. When the pounding occurs, shut down the machine for a half minute. This will allow pressure to be released in compressor, preventing the blowing of seal. If the seal should blow even when this precaution is taken, it will not damage the seal—the seal will reseat itself. When the seal blows, alcohol and lubricant are thrown all over the flywheel belt and machine compartment. Be sure to clean this up on completion of the job, otherwise odors and slipping belt will result.

14. Rinse the system with a quart of clean alcohol—this time being careful to avoid the admission of air. (In other words, keep suction tubing immersed in the alcohol.)

15. Shut down machine just before the last of the alcohol is drawn from the bottle. Throw away any alcohol left in the bottle.

16. Start machine up after pouring a half pint of "Alcozol" (refrigerant) into the bottle. The "Alcozol" will build up pressure in the system, forcing the rinsing alcohol out. (If the discharge does not come out clear, rinse again with another quart of alcohol followed by a half-pint of "Alcozol.")

17. Just before the last of the "Alcozol" is drawn into the system, place finger over the end of the suction tubing to prevent admission of air, and allow machine to operate until no more liquid discharges. (Never allow machine to operate with the suction end of tubing open after rinsing, as we want to keep moist air out of the system.)

18. Shut down machine before removing finger from end of suction tubing.

19. Reconnect system with a minimum of delay—thus keeping it as free as possible of atmospheric moisture.

The system is now clean and the strainerless expansion valve fitting should be replaced by a fitting with clean strainer. The expansion valve ball, ball retainer, and spring should be cleaned and reassembled in the expansion valve, and the ¼" liquid line reconnected—using a clean cartridge strainer. Strainers can be cleaned by placing them in alcohol which will dissolve the dirt—the dissolved dirt being removed by blowing through the screen in the opposite direction to that from which the dirt entered.

20. Flush out compressor three times with new lubricant.

21. Test for leaks.

22. Recheck by Zero Test.

If non-freeze solution (brine) leaked into the system through a defective expansion coil in the brine tank, it is necessary to repair or replace the brine tank and then, *before cleaning system*, it is necessary to flush out the compressor once with new lubricant, and to recharge with lubricant.

Charging System with Refrigerant
Checking Amount of Refrigerant
Discharging Refrigerant
Purging System of Air

To accomplish any or all of the four acts as indicated by the caption above, proceed as follows:

1. Connect the measuring bottle to the pressure gauge opening on receiver valve.

2. Remove plug on end of measuring bottle.

3. All valves of system should be open, excepting valve on vacuum gauge fitting.

(When receiver is fitted with new style (Mueller type) valve, as illustrated in Figure 8, December issue, the valve should be opened only half way.)

4. Open valve of measuring bottle slowly.

5. Start up compressor and continue operation for five minutes after pressure in measuring bottle is released. This will evacuate all air from system and discharge all refrigerant into the measuring bottle.

If condensing unit is exposed to temperatures below 54.5° F. it might be necessary to warm up the receiver by means of hot water and rags in order to build up a pressure sufficient to discharge the refrigerant.

6. With a flash light look into the measuring bottle through the open end. A complete charge of 16-ounces of "Alcozol" will exactly fill the measuring bottle.

7. To recharge system, fill measuring bottle to top; compressor should still be operating.

8. Replace plug on measuring bottle tightly.

9. Close circulating valve on receiver.

10. Observe frost on ⅜" line from expansion valve to brine tank. When frost disappears, it indicates that all the refrigerant has been discharged out of the filling bottle into the system. Of course, if expansion valve is not set for normal vacuum this line might not frost. However, it will be cold as long as the refrigerant is passing through it. (Vacuum gauge will read 28" when full.)

11. Close valve on bottle.

12. Open circulating valve on receiver.

13. Close valve to pressure gauge opening on receiver. Note: If new style (Mueller type) valve is used on receiver, of course 12 and 13 are accomplished simultaneously.

14. Remove measuring bottle.

15. Check up pressure-temperature relation and vacuum.

Purging (Emergency Method)

Another way of removing air from the system is by purging. This is not so certain as the above method and there is uncertainty as to the amount of charge left in the system when this method is used. It is, however, unnecessary in this case to have a measuring bottle.

Purging is most effective after the machine has been shut down for a while. It is accomplished by partially closing the two-way condenser shut-off valve and allowing a small amount of gas to escape through the gauge port (or by loosening the hold-down bolts of the lubricant separator chamber head when not equipped with a two-way condenser shut-off valve—in this case the valve or ell is open). The escaping gas carries with it the air from the condenser. Do not break the flare joint at the condenser shut-off valve for purging. Do not permit liquid refrigerant to escape. This will occur if the gas escapes at too rapid a rate.

After purging, replace gauge plug (or tighten separator head), open condenser shut-off valve all the way and start machine. After fifteen minutes take temperature-pressure reading and compare with table. If pressure is more than two pounds high, repeat purging operation.

Test for leaks at each connection disturbed for purging.

Method of Flushing Out Compressor

1. Close condenser shut-off valve or plug off ⅜" connection on condenser coil when valve is omitted.

2. Remove separator cover from compressor.

3. Remove back bearing plate and allow old lubricant to discharge.

4. Place clean rag over top of compressor.

5. Start up motor and allow machine to run.

6. Replace back bearing plate after all lubricant is discharged.

7. Pour fresh lubricant in top of compressor. It is not necessary to stop motor to do this.

8. Allow machine to run for a few minutes and then remove back bearing plate and discharge.

9. Repeat this three times to make sure that all alcohol is cleaned out of the compressor.

10. After flushing out compressor, refill same with fresh lubricant to the level of the plug in the lubricant separator chamber of the compressor. When flushing is done following cleaning of system, it will be necessary to refill compressor with fresh lubricant up to the top of the lubricant separator chamber.

The Automatic
Condensing Water Regulator
History—Types—Operation—Application

By C. F. TOUSSAINT*

THIS control received very little attention until recent years when economical and efficient operation of refrigeration systems became a necessity.

The function of the automatic condensing water regulator is two fold. First, it must supply sufficient water to maintain any predetermined condensing pressure, second, it must be sensitive to condensing pressure changes, diminishing and increasing water flow accordingly.

The first automatic condensing water regulators had their inception about fifteen years ago. These regulators were of the direct diaphragm operated variety, similar in design to the cross section shown in Figure 1.

Operation of these regulators is as follows:

Refrigerant condensing pressure actuates the diaphragm, No. 3, Fig. 1, which provides the necessary power to open the water valve against the main line water pressure. The point of opening is adjustable by means of the main spring adjusting screw, 8. Capacity of the valve may be varied by means of the stem length adjusting screw, 12. For example, on a plant where ammonia is used as a refrigerant, the valve is set to start condensing water flow at 125 lb. gauge and the

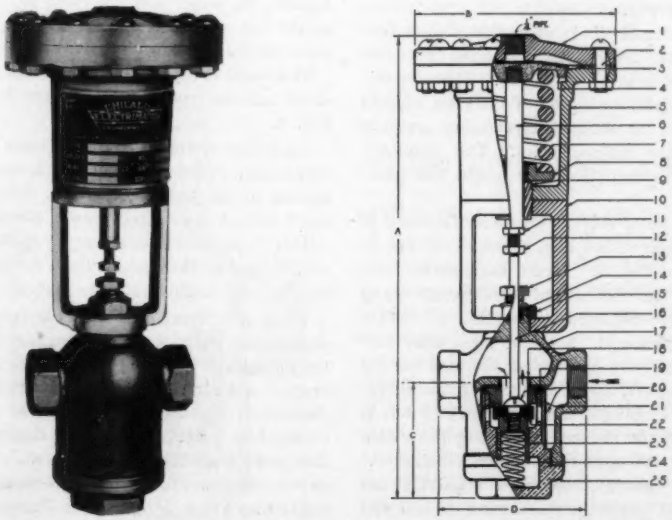

FIG. 1. DIRECT DIAPHRAGM OPERATED VALVE. EXTERIOR AND INTERIOR VIEW

* Chief Engineer, Electrimatic Corporation of Chicago.

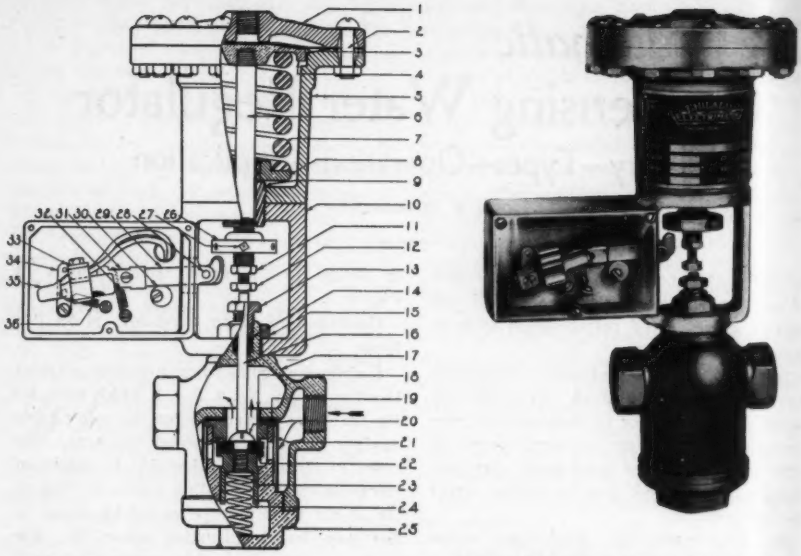

FIG. 2. DIRECT DIAPHRAGM OPERATED VALVE WITH HIGH PRESSURE CUT-OUT

condensing pressure of 150 lb. gauge must be maintained.

It is found that with the water flow started at 125 lb. the operating pressure would not rise above 140 lb. This necessitates a slight closing off of the stem adjusting screw, 12, until the condensing pressure reaches the desired point. The regulator then will automatically maintain this pressure.

This type of valve is also manufactured in combination with a high pressure cut-out as shown in Fig. 2. Upon examination you will find that the cut-out is independent and separately adjusted regardless of water valve adjustment. Some of these units now in the field have mechanical switches but for the most part, manufacturers of this equipment have changed to the mercury switch as shown, as the chances of fouling from dirt, moisture and open contacts are eliminated.

The diaphragm operated regulator has proven its merits in years gone by and still is a big factor in the automatic regulator field.

The solenoid valve was next in line and used quite extensively on small low pressure refrigeration units. It however, did not regulate the water flow according to requirements but operated only as a stop valve when the compressor shut down.

This valve is rapidly being replaced by the direct bellows type water regulator shown in Fig. 3.

Operation of this valve is the same as the diaphragm powered valve. It however, is limited in size to ¾" pipe lines due to the small size of the bellows power element.

This type of valve is very popular and widely used at the present time, for sulphur dioxide and methyl chloride systems.

With the advent of Freon the automatic condensing water regulator became one of the most important controls used for refrigeration and air conditioning. Its operating characteristics and capacities had to be changed to meet the exacting demands of this new and critical refrigerant. Fig. 4 shows a cross section of the condensing water regulating valve designed for Freon. This valve is bellows operated and super sensitive in regulation. Its regulation is not affected by varying main line water pressures due to the pilot control of the main or operating

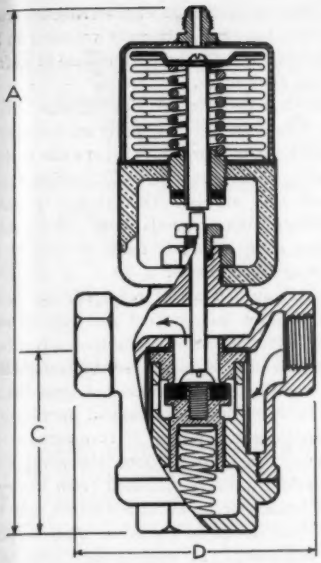

FIG. 3. DIRECT BELLOWS TYPE WATER REGULATOR.

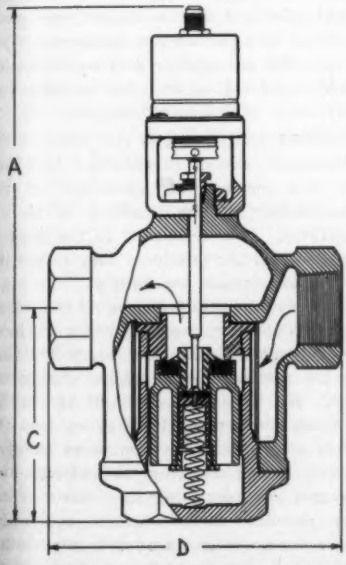

FIG. 4. CONDENSING WATER REGULATING VALVE FOR FREON.

piston. The bellows operates only the small pilot piston, the main piston following in direct proportion to the flow thru the by-pass port in same. The range of these valves is 90 lb. gauge to 190 lbs. with an operating differential of 15 lb. maximum. Water pressure drop across the valve is at a minimum. The ports and passages of this valve are oversized giving a very low water pressure drop across it. Complete data and characteristics of this valve will be published in this magazine in an early issue.

DOOR GASKET SERVICE

THE Jarrow Products Corporation, Chicago, manufacturers of all kinds of refrigerator door gaskets, both rubberized and all rubber, for both household and commercial refrigerators, have just opened a new department which will be devoted to the special handling of door gasket inquiries from the refrigeration service engineer.

These orders will be handled through the local jobbers, who carry a complete stock of the Jarrow gaskets. This firm invites inquiries from the refrigeration service man, regarding any problem which may arise, with reference to door gasket installations.

Inquiries should be addressed to the company at 141 W. Austin Ave., Chicago.

THIRD LECTURE RELEASED BY R. S. E. S.

THE third lecture in the educational course prepared by the National Educational and Examining Board has been released to members of the Society, and deals principally with the various properties and characteristics of the three principal refrigerants, namely, sulphur dioxide, methyl chloride and Freon. In presenting this lecture course to the members Mr. George H. Clark, chairman, states that the next bulletin will be concerned with five types of household refrigerating systems in common use, classified according to the pressure reducing device used. Following this lecture the course will continue with the study of multiple systems and the regulation of multiple temperature systems.

The REFRIGERATION SERVICE ENGINEER

A Monthly Illustrated Journal, Devoted to the Interests of the Engineer Servicing Refrigeration Units, Oil Burners and other Household Equipment.

Vol. 3 January, 1935 No. 1

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Official Organ
REFRIGERATION SERVICE ENGINEERS' SOCIETY

ANOTHER YEAR

EACH year prospects for the servicing business continue to look brighter and assume greater proportions. Increased sales in domestic refrigerators, more commercial refrigeration applications all tend to reflect in more work for the business of refrigeration servicing. Every piece of refrigerating equipment sold may be eventually subject to mechanical ills, requiring the expert attention of a refrigeration service man.

The business of servicing has assumed such proportions during the past few years that it is recognized today as a most important part in the general picture of mechanical refrigeration. Company-operated service stations have of course endeavored to control their own machine servicing where such facilities have been set up and maintained, and in certain localities servicing has been allotted to reputable and responsible independent servicing organizations. Independent servicing of course has focused attention on itself because of the service it has rendered and is capable of rendering in the hands of qualified service men. These men have gained practical and unlimited experience in their contacts with various equipment in the field and it is no idle boast that they have contributed engineering information that has been extremely valuable in improving the design and operation of refrigeration equipment.

The independent service station has a most important job. Usually such a station is located in a community where the amount of refrigeration business will justify future growth and profits. This growth is solely dependent upon good work and consequently every effort is made to justify the customers' confidence.

The manufacturer of refrigerating equipment and the independent servicing organization have problems of mutual advantage. There should be a closer understanding. The manufacturer is dependent upon his future business on the successful operation of his equipment. Where it is necessary for servicing work to be done the service organization, whether operated from the company branch or as an independent, has two important duties to consider; first, to place the equipment in satisfactory operating condition thereby making a better and more satisfied customer and, secondly, to remember at all times that the refrigerating equipment was bought originally because the householder felt his investment was good. It should be a part of the service man's job to keep the householder sold on his equipment explaining to him the stability and competency of the manufacturer.

Without exception it is the desire of the independent service organization to follow the best recommended practices of the manufacturer in the handling of his refrigerator. It is his desire to use genuine parts so that the purchaser may secure the utmost satisfaction indefinitely. The practice of several manufacturers of not selling their genuine replacement parts to independent service men is a policy that has created considerable discussion during the past. We have appreciated their position in which their parts have fallen into the hands of men who have not been qualified to do a proper servicing job and as a consequence the poor work has been a reflection on the manufacturer's equipment. However, we believe that this is a matter that can be satisfactorily adjusted for all concerned.

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; with special reference to servicing and installation of domestic and small commercial equipment; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

ASSOCIATION HEADQUARTERS: 433-435 North Waller Ave., CHICAGO, ILL.

NEW YORK CHAPTER

NEW YORK CHAPTER at its meeting of November 28 considered the report of the Committee on Flat Rate Charges previously appointed by President Herkimer.

The report submitted November 20, 1934, by the committee, consisting of Messrs. Merenda, Curley, Waters and O'Donohue, Secretary, was read and discussed. Revisions were suggested and resolutions offered to tabulate revised charges for 1935.

The following schedule of service charges for the year 1935 was adopted by the New York Chapter of the Refrigeration Service Engineers' Society.

Schedule of 1935
Flat Rates and Service Charges

Item	Material and Labor	Service Operation
1	$13.50	Replacing and re-installing rebuilt ⅛ or ¼ hp. motor.
2	22.50	Furnish and install new ⅓ or ½ hp. motor.
3	15.00	Remove, overhaul and install standard domestic compressor, single cylinder.
4	22.00	Overhaul and install standard domestic compressor, twin cylinder.
5	28.00	New domestic compressor, single cylinder.
6	7.00	Drier installed.
7	9.00	Furnish and install new domestic thermostat of same type.
8	18.00	Furnish and install new thermostatic expansion valve and set.
9	2 Hrs.	Remove and re-install old or duplicate new compressor.
10	2 Hrs.	On stick-ups, install new or rebuilt compressor.
11	2 Hrs.	If seal leaks, replace compressor.
12	1 Hr.	Replace one gasket.
13	1 Hr.	Replace one compressor valve.
14	1 Hr.	Adding oil to compressor.
15	1 Hr.	Fan belt replacement.
16	3 Hrs.	Plugged receiver or plugged up liquid or suction line.
17	3 Hrs.	Remove and replace duplicate domestic float.
18	1 Hr.	Purge system.
19	6 Hrs.	Remove—replace coil or direct expansion evaporator.
20	T & M	Remove commercial dry coil.
21	T & M	Remove and replace commercial float.
22	T & M	Dehydrating system.
23	T & M	Thermostat change-over from one style to another.
24	1 Hr.	Domestic thermostat installed.
25	2 Hrs.	Commercial thermostat installed.

Item	Material and Labor	Service Operation
26	1 Hr.	Pressure switch on domestic unit installed.
27	1 Hr.	Thermostatic expansion valve installed. Set T & M.
28	1 Hr.	Replace motor.
29	1 Hr.	Replace fuse.
30	1 Hr.	Check refusal to start or stop.
31	1 Hr.	Charging Refrigerant.

Labor charges are based on $3.50 for first hour's work and $1.50 for every hour thereafter and a 50% mark-up on cost of material.

The charge of $3.50 the first hour is equivalent to a $2.00 service charge plus $1.50 per hour labor. Above figures do not include hauling or car expense. Allow 25c an hour for car expense; or $2.00 per eight-hour day.

CHICAGO CHAPTER

Minutes of December 11

IN the absence of President Fowler, First Vice-President R. B. Vanston presided. The educational part of the program was devoted to an excellent talk given by Mr. Herman Goldberg, an active member of Chicago Chapter, who spoke at length on the subject of good fellowship between the members and for each member to strive for the betterment of Chicago Chapter so that it might become the outstanding chapter of the National Society.

A lively discussion took place in reference to increased interest in chapter meetings and Mr. Harry Armstrong suggested that a committee for the betterment of Chicago Chapter should be formed and that this committee should be charged with the responsibility of bringing up at each meeting some constructive suggestions for discussion. It was also suggested that after the election of officers on January 8 that consideration be given to a banquet for the installation of new officers.

Meeting of January 8

Chicago Chapter held an important meeting on January 8, it being the event of its first annual meeting as a charter chapter of the National Society. President Fowler presided. All officers were present with the exception of Secretary Frank Kap, and it was felt that Mr. Kap had sufficient and good reason for his absence as he recently celebrated his wedding.

The reports of the Auditing Committee and Treasurer were presented and after the completion of the unfinished business President Fowler announced that the next order would be the election of officers, and appointed a nominating committee who suggested the following officers for 1935:

Officers and Board of Directors

President—Paul Jacobsen.
First Vice-President—J. S. Northcote.
Second Vice-President—Fred H. Roth.
Treasurer—Ivar Skipple.
Secretary—Harry D. Busby.
Sergeant-at-Arms—Clarke Forman.
Joseph Corso, R. L. Hendrickson, H. J. DeGan.

Board of Advisors

T. J. Fowler.
Ralph B. Vanston.

Chairman of Educational Committee

C. E. Hamilton.

Further nominations were asked from the floor and none being presented it was regularly moved and seconded that the officers as nominated be elected by acclamation.

Paul Jacobsen is one of the earnest workers of Chicago Chapter and enjoys the confidence of all the members. In accepting the presidency of Chicago Chapter he said in part as follows:

"In accepting the honor of presidency of Chicago Chapter I feel confident that I am expressing the appreciation of every one of our members when I say that we owe much to the retiring officers for their excellent work in guiding Chicago Chapter through its formative period, and I think that it is befitting at this time that we assure these officers of our sincere appreciation and particularly our good friend Thomas Fowler, who, we know, as National President will continue his splendid efforts in behalf of the entire Society.

Following President Jacobsen's talk the other officers were called upon and responded briefly and assured the Society of their cooperation in the plans which President Jacobsen had outlined.

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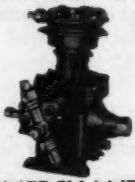

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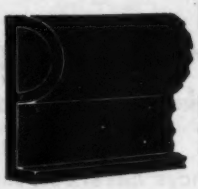

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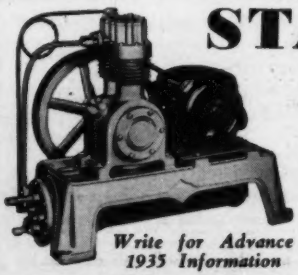

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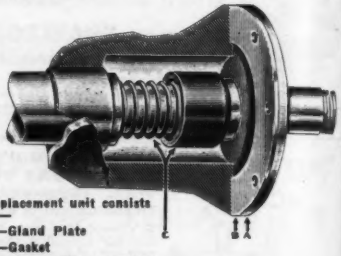

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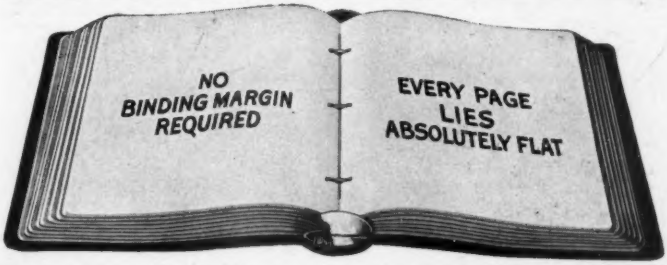

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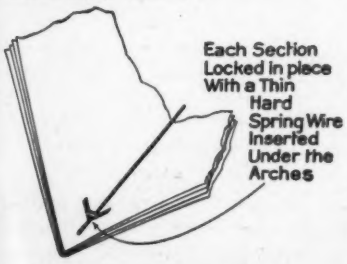

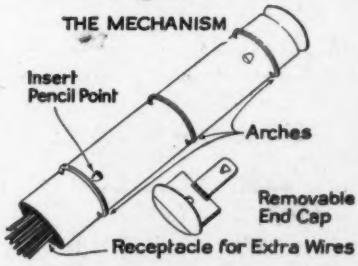

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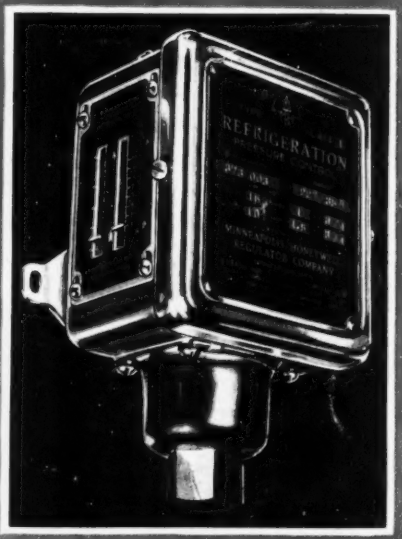
MERCURY SWITCHES ARE BEST

for REFRIGERATION CONTROLS



For line voltage controls, such as use on refrigerating equipment, there nothing better than mercury switches.. Minneapolis-Honeywell has long bee the largest manufacturer of open contac switches. Yet with either type to choos from, our engineers unanimously selec Con-Tac-Tor Mercury Switches for Minne apolis-Honeywell Refrigeration Control because of their many exclusive feature and twenty years of successful applicatio Minneapolis-Honeywell Regulator Com pany. 2934 Fourth Avenue South, Minne apolis, Minnesota. Branch or distributin offices in all principal cities.

MINNEAPOLIS HONEYWELL

Control Systems

VISIBLE SCALES

and locking and leveling devices are supplie without extra charge on all Minneapolis Honeywell Refrigeration Controls. All desired pressure or temperature ranges for commercial or air conditioning applications are available.